



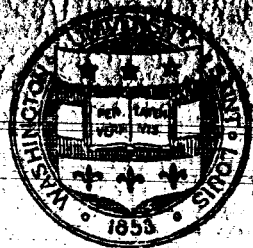
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**LONG TERM IMPACTS OF BIG  
TECHNOLOGY**

**By**

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Working Paper 6801  
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### ABSTRACT

The positive benefits of large-scale technology efforts are well known. They enhance national prestige, contribute to economic growth, and are an investment in future progress. However, it is important to be aware of the unintended but undesirable side effects of big technology, in order to deal with them properly. If we do so, the result may be that governmental technology programs become more attractive than they are at present.

The close, continuing relationship between the Federal Government and its major suppliers of large technical systems is resulting in a convergence between the two, which is reducing much of the distinction between the public and private sectors. To a substantial degree, the government is taking on the traditional role of the private entrepreneur while the companies are becoming less like other corporations and more like government agencies or arsenals.

Government procurement policies need to be modified in order to halt the erosion of the basic entrepreneurial character of the firms that undertake large-scale developmental programs for government agencies. Second thoughts need to be given before we as a Nation agree to the almost uncritical demands for extending the use of the government-oriented corporations to other parts of the public sector.

## LONG TERM IMPACTS OF BIG TECHNOLOGY

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We are all well acquainted with the positive benefits of large-scale technology efforts. Big technology contributes to the growth rate of our economy. It enhances our national prestige. It improves our understanding of the world around us. It expands our educational facilities. Finally, it constitutes an important investment in our future progress. Some perspective and balance is needed in any appraisal.

Hence, now let us turn to the negative aspects of large-scale technology efforts. We may not be as well acquainted with these. The Federal Government of course is the dominant patron of big technology programs. As we examine its dealings with the private industries and research institutions which execute the bulk of these government-sponsored projects, we find important negative impacts on our economy and our society. It is important to be aware of these unintended but undesirable effects, in order to deal with them properly. If we do so, the result may be that governmental technological programs become more attractive than they are at present.

The close, continuing relationship between the Federal government and the major companies working on military, space and related high-technology systems is actually changing the nature of the public sector of the American economy.<sup>1</sup> The relationship is also changing a large branch of American industry. To a substantial degree, the government is taking on the traditional role of the private entrepreneur while the companies are

becoming less like other American corporations and more like government agencies or arsenals. In a sense, the close, continuing relationship between the Federal Government and its major suppliers of large technical systems is resulting in a convergence between the two, which is blurring and reducing much of the distinction between public and private activities in an important branch of the American economy.

This tendency for a convergence between the government and its major contractors needs to be distinguished from other analyses of the interaction between government and private industry. The analysis presented here does not evoke the conspiratorial approach of the discussions of a 'military-industrial complex.' Also, this convergence tendency is narrower than the contention of Professor John Kenneth Galbraith that modern large corporations are becoming part of the governmental administrative complex. As Galbraith puts it in his New Industrial State, "Increasingly it will be recognized that the mature corporation, as it develops, becomes part of the larger administrative complex associated with the state. In time the line between the two will disappear."<sup>2</sup>

To the contrary, I will attempt to demonstrate that the convergence phenomenon here described is limited to one branch of American industry, the aerospace and similar high-technology firms. It will also be shown that the government-oriented corporation is becoming measurably different from large American business firms that primarily cater to industrial and consumer markets.

#### GOVERNMENT PERFORMING PRIVATE DECISION-MAKING

In its long-term dealings with its major suppliers of high technology systems, the Federal Government gradually has taken over directly or indirectly

many of the decision-making functions which are normally the prerogatives of business management. Three key aspects of this public assumption of, or active participation in, private decision-making can be identified: the choice of which products the firm is to produce, the source of capital funds, and the internal operation of the firm. This government involvement in private industry arises in the case of the unique and large-scale nature of military weapon system, space, and related high technology procurement by the government. It hardly characterizes the purchases of standard items by many civilian government agencies through fixed-price contracts awarded via sealed-bid competition.

By awarding massive contracts for research and development (over \$10 billion in the fiscal year 1966), the Department of Defense and NASA have come to strongly influence or determine which new products their essentially common group of contractors will design and produce. In the commercial economy, in contrast, research and development costs normally are only recovered to the extent that they result in the sale of profitable products. Hence, the decisions to embark upon a product research and development program are made there by the sellers, who bear the risk of not recovering their technological investment. Of course, government contractors may and do sponsor and fund some of their own R&D effort. However, the bulk of their R&D is performed under government contract (over 90 percent of the aerospace industry's R&D in 1964 was so funded).<sup>3</sup> Much, if not most, of the remainder is charged as allowable overhead on their government contracts, having met the prior approval of contract administration officials.

The government also uses its vast financial resources to supply the bulk of the plant and equipment used by its major contractors and also a

major part of the working capital that they require. A survey of 13 large contractors covering the years 1957-1961 revealed that the cost of government-supplied property exceeded the value of gross company property reported on corporate balance sheets.<sup>4</sup> Moreover, much of the company-owned property was used by the commercially-oriented divisions of these companies, rather than by the divisions working on government contracts. More recently, during the Vietnam War, Defense Department expenditures for additional plant and equipment to be supplied to ~~the~~ contractors have risen sharply, from \$56 million in the fiscal year 1965 to an estimated \$330 million in 1967.<sup>5</sup>

In addition, approximately \$5 billion of outstanding "progress" payments are held by military contractors. Some individual firms reported that such government-supplied funds exceed their net worth. Government procurement regulations provide specific disincentives for the use of private working capital. Progress payments equal to 80 percent or more of the costs incurred on military contracts generally are provided without interest charge to the contractors. In contrast, should these companies decide to rely on private sources for working capital, their interest payments may not be charged to the contract, and hence must come out of their profits.<sup>6</sup> Presumably, this arrangement results in smaller total cost to the government because of the lower interest rates paid by the U.S. Treasury on the funds that it borrows. However, the result is also to increase the extent to which public rather than private capital finances the operations of government contractors. Hence, the financial stake that the government has in the performance of its R&D suppliers is increased further.

Another and perhaps the most pervasive way in which the Federal Government assumes the management decision-making functions of these companies is through the procurement legislation and regulations governing the contracts it awards. The Armed Services Procurement Regulation requires contractors to accept on a "take it or leave it" basis many standard clauses in government contracts which give the contracting and surveillance officers numerous powers over the internal operations of these companies. These unilaterally determined grants of authority vary from matters of substance to items so minor that they border on the ludicrous. It should be realized that these restrictions generally have been imposed to prevent specific abuses which may arise.

However, the cumulative and long-term impacts on company initiative and entrepreneurship are rarely considered. Viewed as a totality, these restrictions represent a new form of government regulation of industry. This regulation is not accomplished through the traditional independent regulatory commission, but rather through the unilateral exercise of the government's monopsonistic market power.

The authority assumed by the government includes power to review and veto company decisions as to which activities these companies may perform in-house and which they may subcontract, which firms to use as subcontractors, which products to buy domestically rather than to import, what internal financial reporting systems to establish, what type of industrial engineering and planning system to utilize, what minimum as well as average wage rates to pay, how much overtime work to authorize, and so forth.<sup>7</sup>

My favorite example of the more minor matters covered in the detailed and voluminous military procurement regulations is the prescription that

the safety rules followed in the offices and factories of the contractors must be consistent with the latest edition of the Corps of Engineers safety manual.<sup>8</sup> The whole philosophy of close government review of the internal operations of its contractors is so deeply imbedded that insertion of statements such as the following in the Armed Services Procurement Regulation evoke no public or industry reaction:

'Although the Government does not expect to participate in every management decision, it may reserve the right to review the contractor's management efforts...'<sup>9</sup>

Of course, many have contended that cost-plus government contracting has shifted much of the risk-bearing from the industrial seller to the governmental buyer. The use of fixed price contracts has increased in recent years. However, a major share of military contracts still is on a cost reimbursement basis. So long as this remains the case, the government determines which items of cost are "allowable" as charges to the contract and hence, for most practical purposes, which activities and which items of expenditure the company can undertake. This result obtains because disallowed costs directly reduce company net profits.

It needs to be kept in mind that the industry-government relationship is a dynamic one. Numerous changes are made in government procurement regulations in the course of a year, many of them extending the role of the government in the internal operations of the contractors. The list of unallowable costs of defense contractors was lengthened during the years 1953-1961 to include technical displays unapproved overtime, business conferences, bid and proposal expense, employee moving expense, foreign office expense, operation of executive airplanes, and public relations.<sup>10</sup>

A review of revisions in the Armed Services Procurement Regulation in more recent years confirms the continuation of this pattern of increased governmental involvement in the internal decision-making of the contractors. The following is a sample of such recent changes:

1. In contracts for aircraft tires, the contractor must purchase an amount of rubber from the government's stockpile equal to at least 50 percent of the value of the contract. The contractor does not actually have to use the rubber from the stockpile in filling the government contract. He can keep it for his commercial work. Such tie-in contracts, if made between two private firms, would run afoul of the anti-trust laws.

2. Similar requirements must be met in the case of contractors providing aluminum products.

3. Military contractors must buy all of their jewel bearings from the Government-owned Turtle Mountain Bearing Plant at Rolla, North Dakota.

4. In deciding whether costs of professional and consulting services used by a contractor are an allowable charge to a military contract, the government now will consider "whether the service can be performed more economically by employment rather than by contracting." That is, the government now has considerable authority to decide whether one of its contractors needs to hire an outside consultant rather than a permanent employee. The government also had assumed the authority to review the qualifications of the consultant.

5. Help-wanted advertising is not an allowable cost if it is in color. Advertising for employees, if it is to be an allowable cost, must be authorized in advance.<sup>11</sup>

Moreover, the Pentagon is currently reviewing the Procurement Regulation to determine "what actions on the part of the Government are necessary to assure that compensation paid to contractor employees performing on government contracts is reasonable."<sup>12</sup> Clearly, the trend for increased governmental involvement in private business decision-making appears to be a long continuing one.

#### LONG-RUN IMPACTS ON THE PRIVATE SECTOR

The close, continuing relationship of the major, specialized government contractors to the governmental establishment is resulting in some long-term and undesirable structural impacts on this segment of private industry. Numerous specific indications are available of the limited entrepreneurial actions of these government-oriented corporations. The dependence of the shipbuilding companies on government contracts and subsidies is well known; it has resulted in that industry's failure to undertake new product development on its own or otherwise effectively to compete in the open world market.

Similarly, the aerospace industry generally has made only halfhearted efforts to utilize its much vaunted engineering and systems analysis capability to penetrate commercial markets. Most of these attempts have been on a very small scale or were abandoned when substantial private risk capital was required. During the 1963-64 defense cutbacks, these companies reacted passively to the developments, mainly curtailing their operations and waiting for government proposals to bid on civilian agency work on a cost-plus basis.

The most conspicuous exception to this lack of entrepreneurship and willingness to bear risks in commercial markets is the Boeing Company. During the past decade, that company has invested several hundred million

dollars of its own funds in commercial aircraft development, with considerable success. However, should the Federal Government decide to finance the great bulk of Boeing's cost of developing a commercial supersonic airliner, that would represent a return to the long-term trend of greater governmental risk-bearing.

This question of the long-term impacts of the governmental relationship on the private contractors can be examined by comparing the major government-oriented, high-technology companies with other large industrial corporations of approximately similar size. The results are quite revealing. The comparison indicates that the government-oriented companies possess important, measurable characteristics which differ from those of commercially-oriented industrial corporations and that these differences have been increasing in recent years. This would seem to support the contention that it is the specialized, R&D - intensive contractors who are drawing closer to the Government and not, as Professor Galbraith contends, large corporations as a whole.

The following six companies were selected because their contracts from the Department of Defense and the National Aeronautics and Space Administration were estimated to be in excess of three-quarters of their total sales volume in 1965: North American Aviation, Inc., Lockheed Aircraft Corporation, General Dynamics Corp., McDonnell Corp., Grumman Aircraft Engineering Corp., and Thiokol Chemical Corp. These six companies constitute about as many examples of the high-technology, government-oriented corporation as there are data available. In many other cases, necessary statistics on large government contractors cannot be obtained because the organizations are subsidiaries or divisions of corporate conglomerates that only release

financial information on the total company (e.g. Martin-Marietta, Litton Industries, and Textron.)

A six-company civilian-oriented sample was chosen on the basis of the similarity of sales volume in 1965 between these firms and the companies in the sample of government contractors. Generally, they were adjacent firms on the Fortune list of the 500 largest industrial corporations in 1965. Each group reported an aggregate sales volume of \$7.3 billion for the year. The general industry sample contained the following business firms: National Dairy Products Corp., Firestone Tire and Rubber Corp., General Foods, Inc., Aluminum Company of America, Colgate-Palmolive Co., and Purex, Inc.

The two samples were compared, for the years 1962-1965, and also for the period 1952-1955, on the basis of standard financial ratios, traditional stockholder factors, and capital structure. A span of years was chosen in each case to reduce the effect of erratic movements in individual years.

The results of the analysis are contained in Table 1. It can be seen that government-oriented companies tend to operate on much smaller profit margins than do typical industrial corporations -- 2.6 percent versus 4.6 percent during the years 1962-1965. As a result of the large amounts of government-supplied capital, which are not reflected on the books of these companies, the government contractors report a far higher ratio of capital turnover (i.e. dollars of sales per dollar of net worth) during 1962-65 -- 6.8 times versus 2.3 times. Their higher turnover rates more than offset their lower profit margins. Hence, their return on net worth (net profits as a percent of stockholder's investment) was considerably higher -- 17.5 percent versus 10.6 percent during 1962-65.

Table 1

COMPARISON OF GOVERNMENT AND COMMERCIALY ORIENTED CORPORATIONS

<u>Financial Characteristics</u>	<u>Average of Sample of Government Contractors</u>		<u>Average of Sample of Commercial Firms</u>	
	<u>1962-65</u>	<u>1952-55</u>	<u>1952-55</u>	<u>1962-65</u>
Profit margin on sales	2.6%	3.0%	4.5%	4.6%
Capital turnover	6.8x	6.1x	2.9x	2.3x
Return of net worth	17.5%	18.6%	13.0%	10.6%
<u>Investor Evaluation</u>				
Price/earnings multiple	10.9	7.3	10.7	20.6
Bond rating (Moody's)	Ba-Baa	Ba-Baa	A-Aa	A-Aa

Source: Moody's Industrial Manual, 1952-55 and 1962-65; company annual reports, 1952-55, 1962-65.

Moreover, the differences between the two samples widened over the past decade. The sales margins of the government contractors were closer to the general industrial sample during the earlier period (1952-55) than during the more recent years analyzed (1962-65). The same changes are noticeable for capital turnover and return on investment.

Despite the greater relative profitability, the evaluation by the stock market of the Government-oriented corporations has been less favorable than of large business firms as a whole. This results, in part, from the inherent instability of the government market and the historical volatility of the fortunes of individual contractors as specific projects phase in and then phase out. The relatively low payout ratio (the proportion of net income which is disbursed to stockholders in the form of cash dividends) may also have an adverse effect. Reflecting these factors, earnings of the government contractors tend to be more fully discounted,

as shown by lower/price earnings multiples -- 10.9 versus 20.6 for the period 1962-65. The results for 1952-55 were not substantially different.

Similar investor reluctance towards these high-technology, government-oriented corporations is evident in the bond market. Of the six firms which composed the general industry sample, during the period 1962-65, four were able to issue bonds with a rating of either A or Aa (according to the standard Moody's bond ratings); one chose not to issue bonds at all; and the last placed its bonds privately.

Out of the six companies in the government sample, only one issued bonds on the market and these had a relatively low rating of Ba and Baa. One of the firms placed its bonds privately, while the other four did not issue any at all. Again, the results for 1952-55 were similar. These comparisons suggest that it is much easier for civilian-oriented firms to enter the bond market on favorable terms. It would be expected that this reflects the greater degree of risk which is imputed to bonds issued by government contractors.

An attempt to sum up the growing differences between government-oriented and commercially-oriented corporations yields a paradox, but perhaps not an unexpected one. The close dependence of the contractors on the volatile government customer results simultaneously in higher average profitability and lower investor interest. The higher profitability arises mainly because of the free provision of working and fixed capital. The lower stock and bond market evaluation comes about, in part at least, because of the great volatility of government requirements and, hence, of the fortunes of individual contractors.

Another factor influencing investor attitudes may be the inability of these companies to operate successfully in commercial markets because of their preoccupation with meeting government requirements. Certainly other large contractors -- such as General Electric, R.C.A., Honeywell, General Motors, Ford, and A.T. & T. -- which receive the bulk of their sales from consumer and industrial markets encounter more favorable investor attitudes. With reference to Professor Galbraith's forecast of the possibility of the disappearance of that line between the mature corporation and the state, the market at least seems to distinguish increasingly clearly between government-oriented and market-oriented corporations.

#### IMPORTANT POLICY IMPLICATIONS

Recent periods of defense cutbacks gave rise to demands for utilizing the unique research and development and systems management capabilities of military contractors in civilian public sector activities. Given another reduction in military spending in the near future, such action may be an effective short-term means of preventing unemployment in defense areas. However, as a matter of long-term public policy, would it be wise for the nation to expand that branch of industry which increasingly develops the characteristics and mentality of a government arsenal? To a considerable degree, the large government R&D contractors rarely risk large amounts of their own resources in new undertakings, but primarily respond to the initiatives of the governmental customer. This course of action may be a valid profit-maximizing solution for these companies, but it hardly promotes the risk-bearing and entrepreneurship which is characteristic of private enterprise. Should we encourage these companies to expand into civilian government markets in the same type of protected or insulated

environment? Or should more emphasis be given to the possibilities of encouraging, or at least not discouraging, the eventual movement of R&D personnel, facilities, funds and other resources to those other industries which are more accustomed to operating in a commercial business rather than a government environment? Perhaps, an added and unnoticed benefit of arms reduction or disarmament would be the opportunity to reduce if not eliminate this "semi-nationalized" branch of the American economy.

Even in extended cold war periods, the "convergence" tendencies of government contractors may need to be held in check in order to maintain their present high rate of technological innovation which forms such a basic part of the Nation's national security base. An important justification of the government-oriented (and hence publicly assisted) corporation is that it is in a position most readily to undertake scientific and technological innovation. Yet, innovation is likely to come forth only if there remains some risk of not innovating due to competitive pressures. Such pressures may come from existing government suppliers as well as from companies now oriented to commercial markets.

The optimal in the government-supplier relationship, hence, may be substantially short of either arsenalization or the informal contact of a free market. The desired result may be enough stability to assure technical competence but enough uncertainty to prod some mutual participation in the innovation process.

Hence, it would appear that governmental procurement policies and practices need to be modified in order to halt the erosion of the basic entrepreneurial character of the firms that undertake large-scale developmental programs for government agencies. In any event, some second thoughts

may need to be given before we as a Nation agree to the almost uncritical demands for extending the use of these government-oriented corporations to other parts of the public sector.

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